DESIGN & PLAN REVIEW CONSIDERATIONS FOR FLAMMABLE/COMBUSTIBLE LIQUIDS STORAGE ROOMS

(STORED OR USED WITHIN A COMMERCIAL BUILDING)

WHAT TYPES OF CONSTRUCTION SHOULD ALERT A DESIGNER TO A POTENTIAL DESIGN ISSUE?

Design professionals should verify with building owners / tenants if flammable/combustible liquids will be stored ***or*** used in conjunction with a commercial building (whether being built, altered, etc.).

Here are some examples of occupancies that should ***red flag*** that flammable/ combustible liquids or gases are ***likely*** to be present and a storage room or tank approval may need to be sought:

- Repair Or Service Garages
- Woodworking Shops, Wood Fabrication Plans
- Cold Storage Use (*Nonrefrigerated Facilities*)
- School Specialty Areas Such As Chemistry Labs, Woodworking Shops, Art Rooms, Automotive Repair Shops, Body Shops, Ag Shops, Etc.
- Physical Plant "Storage" (*E.G., At University Or Other Institutions*)
- ***Any*** "Hazardous Material" Storage
- Facilities Involved In Plastics Manufacture
- Dry Cleaning Stores Or Facilities
- Storage Areas in Hospitals, Clinics, Labs, Etc.
- Facilities That Use "Organic Coatings"
- Storage Areas in Mercantile Establishments That Sell any Kind Of Chemicals, Sell Automotive Supplies, Or Perform Service Work, Etc.

If a chemical or material being used or stored is either a flammable /combustible liquid or gas, the building designer ***should request the material safety data sheet (MSDS)*** for each chemical with unknown properties or of concern.

Information that should be evaluated on the MSDS includes the flashpoints of the chemicals, the chemical properties (Does the chemical react with water? Is it corrosive?, etc.), and the hazards the chemical presents to people.

OTHER KEY INFORMATION THAT SHOULD BE ESTABLISHED TO DETERMINE REPORTING, STORAGE, SPRINKLERING OR OTHER REQUIREMENTS ARE:

- What are the quantities of each hazardous material or flammable /combustible liquid present, whether for manufacturing process, use or storage?
- If more than one day's usage of chemical is in the building, then must provide proper storage with cabinets, rooms or approved tanks. (NFPA 5-5.4)
- What type/size of containers or vessels will these materials or chemicals be stored in?
- Have the MSDS sheets available when working with the fire department and other code enforcement staff.
- Suggestion for improved site safety: maintain any emergency contact or special information where it is readily available to fire department staff or other staff who may respond in the event of an emergency or accident within the building or area where the chemicals or materials are.

HOW DOES THIS IMPACT THE BUILDING PLAN SUBMITTAL?

For purposes of building plan review and submittal, it is important that the designer/owner clearly state on the application form as to whether or not flammable /combustible liquids will be present in the building.

Also, note that a building over 3000 square feet in floor area used for "high hazard occupancies" (such as manufacturing, processing or storage involving highly combustible or explosive products or materials) will require a complete automatic fire sprinkler system as per COMM 52.013(7). Also, shortened exit distance of 75' per COMM 54.02 may apply.

CONTAINERS/ROOMS FOR FLAMMABLE/COMBUSTIBLE LIQUID STORAGE

Information regarding proper storage of containers for flammable /combustible liquids (use MSDS sheets to identify) or gases (such as propane or compressed natural gas) is available through the district Fire Safety Consultants. Please call (608) 266-3151 for the name of the consultant nearest your project.

See the following information from COMM 10 and NFPA 30 for design, construction information for these rooms and containers.

STORAGE OF FLAMMABLE & COMBUSTIBLE LIQUIDS

CODE REFERENCES: s. Comm51.08 (2), Table 51.08-2 references Chapter Comm 10.

CHAPTER COMM 10 (FLAMMABLE & COMBUSTIBLE LIQUIDS)

The purpose of COMM 10 "is to provide for the safe storage, installation, operation, use, maintenance and transportation of flammable and combustible liquids." COMM 10 is concerned primarily with those issues surrounding the bulk storage and dispensing of flammable liquids or with the protection of the state's waters from contamination by flammable and combustible liquids.

NFPA 30 (FLAMMABLE & COMBUSTIBLE LIQUIDS)

COMM 10 adopts by reference the Flammable and Combustible Liquids Code, NFPA No. 30-1987 Edition. Most of the standards referenced herein are from NFPA 30, 1993 edition, but are similar in intent or the same as the 1987 edition. The building code adopts NPFA 30, 1996. Designers are required to use the most restrictive requirements listed.

DEFINITIONS:

COMBUSTIBLE LIQUID - means a liquid having a flash point at or above 100 degrees f.

FLAMMABLE LIQUID - means a liquid having a flash point at or below 100 degrees f. and having a vapor pressure not exceeding 40 p.s.i. (absolute) at 100 degrees f. These liquids are known as class I liquids.

STORAGE CABINET- Metal or wood cabinets of 120-gallon capacity or less meeting the design and construction requirements outlined herein.

INSIDE STORAGE ROOM - Is a room totally enclosed within a building and having no exterior walls.

CUTOFF ROOM - is a room within a building and having at least one common exterior wall

ATTACHED BUILDING - is a building (room) which has only one common wall with another building.

CLASSIFICATION OF SOME COMMON LIQUID BULK PRODUCTS

CLASS	PRODUCT	FLASH POINT	BOILING POINT
FLAMMABLE LIQUIDS CLASS IA	AUTOMOTIVE GASOLINE AVIATION GASOLINE JET FUEL JP-4 PENTANE VINYL CHLORIDE ETHYLENE CHLORIDE ISOPRENE PROPYLENE	BELOW 73 DEG F.	BELOW 100 DEG F.
FLAMMABLE LIQUIDS CLASS IB	ACETONE BENZENE COAL TAR OIL DENATURED ALCOHOL ACROLEIN CHLOROBENZINE METHYL ALCOHOL (METHANOL) HEXANE STYRENE METHYL ETHYL KETONE (MEK) NAPTHA, VM and P CRUDE PETROLEUM TOLUENE ETHYL ALCOHOL HEPHANE VINYL ACETATE XYLENE	BELOW 73 DEG. F.	ABOVE 100 DEG. F.
FLAMMABLE LIQUIDS CLASS IC	TURPENTINE WHISKEY	BETWEEN 73 AND 100 DEG. F.	
COMBUSTIBLE LIQUIDS CLASS II	ACETIC ACID CAMPHOR OIL CELLOSOLVE SOLVENT FUEL OIL NO. 1 FUEL OIL NO. 1-D JET FUEL JP-5 JET FUEL JP-6 KEROSENE MINERAL SPIRITS NAPTHA STODDARD SOLVENT	BETWEEN 100-140 DEG. F.	

CLASS	PRODUCT	FLASH POINT	BOILING POINT
COMBUSTIBLE LIQUIDS CLASS IIIA	BRAKE FLUID CREOSOTE PHENOL DIESEL FUEL (65 DIESEL INDEX) GAS OIL FUEL OIL NO. 2 FUEL OIL NO. 2-D FUEL OIL NO. 4 FUEL OIL NO. 5 FUEL OIL NO. 6	ABOVE 140 DEG. F. AND LESS THAN 200 DEG. F.	
COMM 10 FLAMMABLE & COMBUSTIBLE LIQUIDS CODE DOES NOT APPLY TO THESE PRODUCTS WHOSE FLASHPOINTS EXCEED 200 DEG F. (IIIB)	ASPHALT CASTOR OIL GEAR OIL HYDRAULIC FLUID LINSEED OIL LUBRICATING OIL MINERAL OIL MOTOR OIL NEAT'S FOOT OIL PENETRATING OIL TRANSFORMER OIL TRANSMISSION OIL EDIBLE OILS	300-550 445 450 340 535 300 380 275-600 430 295 295 310 450-640 (DEG. F.)	

FLAMMABLE LIQUIDS STORAGE CABINETS

1. MAXIMUM STORAGE QUANTITIES PERMITTED

- Maximum 120-gal per cabinet (total of all liquid classifications combined)
- Maximum 3-cabinets per fire area
- Of this total, a maximum of 60-gal for class 1 & 2 combined
- Industrial occupancies
- Additional cabinets permitted in same fire area if separated by 100-ft

2. CABINET VENTING

Not required

- All vent openings shall be sealed

If vented for other reasons (health & safety)

- Vented to outside of building
- Mechanical ventilation preferred per NFPA 91
- Exhaust from the bottom with makeup air into the top
- No manifolding of vents
- Acceptable to authority having jurisdiction

3. METAL CABINET CONSTRUCTION

- Listed by cabinet manufacturer or built as outlined below
- Number 18-gauge sheet steel (double walled with 1 1/2-in air space)
- Joints riveted, welded, or other equally effective means
- Doors
- Three point door latch arrangement
- 2-in raised sill (liquidtight) or drip pan for spill containment

4. WOODEN CABINET CONSTRUCTION

- Minimum 1-in exterior grade plywood
- Joints rabbetted & fastened in 2 directions with wood screws
- Doors
- 1-in rabbetted overlap for 2 door cabinets
- Means of latching provided
- Hinges mounted to not lose their holding capacity during a fire exposure
- 2-in raised sill (liquidtight) or drip pan for spill containment

DESIGN & CONSTRUCTION REQUIREMENTS FOR INSIDE FLAMMABLE AND COMBUSTIBLE LIQUIDS STORAGE ROOMS (SEE NFPA 30 FOR SPECIFIC DETAILS)

INSIDE STORAGE ROOMS, CUT-OFF ROOMS, ATTACHED BUILDINGS, STORAGE TANKS:

1. SEPARATED FROM OTHER PARTS OF BUILDING BY FIRE RESISTIVE CONSTRUCTION(Interior Walls, Ceilings, Intermediate Floors) (NFPA 30, 4-4.2.1)
    - Inside storage room less than 150 sf. (1 hr)
    - Inside storage room more than 150 sf. (2 hr)
    - Cutoff room and attached buildings less than 300 sf (1 hr)
    - Cutoff room and attached buildings over 300 sf (2 hr)

2. FIRE DOORS WITH AUTOMATIC CLOSERS SHALL BE PROVIDED AS FOLLOWS
   - 1 hour construction requires ¾ hour rated door
   - 2 hour construction requires 1 hour rated door
   - 4 hour construction requires 3 hour rated door
3. CONSTRUCTION DESIGN OF EXTERIOR WALLS SHALL PROVIDE FOR READY ACCESSIBLITY FOR FIRE FIGHTING THROUGH PROVISION OF ACCESS OPENINGS, WINDOWS OR LIGHTWEIGHT NON-COMBUSTIBLE WALL PANELS.
4. WHERE CLASS 1A OR 1B LIQUIDS OR UNSTABLE LIQUIDS ARE DISPENSED, OR WHERE CLASS 1A LIQUIDS ARE STORED IN CONTAINERS LARGER THAN 1 GALLON, THE EXTERIOR WALL OR ROOF CONSTRUCTION SHALL INCORPORATE DEFLAGRATION VENTING. (SEE NFPA 68)
5. EXCEPT FOR DRAINS, FLOORS SHALL BE LIQUIDTIGHT AND THE STORAGE AREA SHALL BE LIQUIDTIGHT WHERE THE WALLS JOIN THE FLOOR.
6. MEANS SHALL BE PROVIDED TO PREVENT THE FLOW OF LIQUIDS INTO ADJOINING AREAS OF THE BUILDING. THIS SHALL BE ACCOMPLISHED BY ONE OF THE FOLLOWIING METHODS OVER THE ENTIRE WIDTH OF EACH OPENING:
   - Non-combustible liquid tight raised sills, curbs or ramps of a suitable height(1987 Edition Says 4” Curb, 1993 Edition Is Silent)
   - Open-grated trenches
   - Other means acceptable to the authority having jurisdiction
7. WHERE AUTOMATIC SPRINKLERS ARE PROVIDED, MEANS SHALL BE PROVIDED TO PREVENT BURNING LIQUIDS FROM EXPOSING OTHER STORAGE PILES OR RACKS AND FROM EXPOSING OTHER IMPORTANT BUILDINGS, ADJOINING PROPERTIES OR CRITICAL NATURAL RESOURCES.
8. ELECTRICAL EQUIPMENT AND WIRING IN INSIDE STORAGE ROOMS SHALL BE SUITABLE FOR CLASS I, DIVISION 2 HAZARDOUS LOCATIONS. (NFPA 70)
9. WHERE CLASS I LIQUIDS ARE DISPENSED OR WHERE CLASS II OR CLASS III LIQUIDS AT TEMPERATURES AT OR ABOVE THEIR FLASH POINTS ARE DISPENSED, ELECTRICAL EQUIPMENT AND WIRING SHALL BE SUITABLE FOR CLASS I, DIVISION 2 HAZARDOUS LOCATIONS. IN ADDITION, ANY ELECTRICAL EQUIPMENT LOCATED WITHIN 3 FEET OF DISPENSING NOZZLES SHALL BE SUITABLE FOR CLASS I, DIVISION I HAZARDOUS LOCATIONS.
10. LIQUID STORAGE AREAS WHERE DISPENSING IS CONDUCTED SHALL BE PROVIDED WITH EITHER GRAVITY OR CONTINUOUS MECHANICAL EXHAUST VENTILATION SYSTEM. IF CLASS I LIQUIDS ARE DISPENSED, THEN MECHANICAL VENTILATION SHALL BE USED.
    - Exhaust air shall be taken on one side of the room within 12 in. Of the floor.
    - Make-up air inlets shall be on the opposite side of the exhaust air outlet and be within 12 in. Of the floor.
    - Exhaust shall be directed to the exterior of the building without recirculation.
    - Mechanical ventilation shall provide at least 1 cfm of exhaust per sf of floor area, but not less than 150 cfm. The mechanical ventilating system for dispensing areas shall be provided with an airflow switch or similar device that is interlocked to sound an audible alarm upon failure of the ventilation system.

11. CLASS 1 LIQUIDS SHALL NOT BE PERMITTED TO BE STORED IN BASEMENTS. CLASS II AND CLASS IIIA SHALL BE PERMITTED TO BE STORED IN BASEMENTS PROVIDED WITH AUTOMATIC SPRINKLER SYSTEMS

MAXIMUM STORAGE LIMITATIONS FOR SELECTED OCCUPANCIES

OCCUPANCY	LIQUID TYPE (CLASS) MAXIMUM CONTAINER SIZE	MAXIMUM QUANTITY	MAXIMUM HEIGHT	FIRE SEPARATION
GENERAL PURPOSE WARE-HOUSE	1A IB (1 GALLON) IC(1GALLON) II (5 GALLONS) IIIA (60 GALLONS) IIIB (60 GALLONS)	NOT PERMITTED 660 GALLONS 660 GALLONS 1375 GALLONS 2750 GALLONS 13,750 GALLONS	 5 FEET 5 FEET 5 FEET 10 FEET 15 FEET	 4 HOUR 2 HR (AHJ)*
DWEL-LINGS (3 UNITS OR LESS) AND GARAGES	I & II COMBINED IIIA	25 GALLONS 60 GALLONS	N/A N/A	N/A N/A
ASSEMBLY OCCU-PANCIES, DWELLING OVER 3 UNITS, HOTELS	I OR II III	10 GALLONS 60 GALLONS	N/A N/A	MUST BE IN STORAGE CABINET, SAFETY CAN OR INSIDE STORAGE ROOM
OFFICE, EDUCA-TIONAL INSTITU-TIONAL	I I & II COMBINED I& II IN SAFETY CANS III	1GALLON 10 GALLONS** 25 GALLONS** 60 GALLONS	N/A N/A	QUANTITIES IN EXCESS OF THOSE SHOWN MUST BE IN STORAGE CABINETS OR INSIDE STORAGE ROOM

OCCUPANCY	LIQUID TYPE (CLASS) MAXIMUM CONTAINER SIZE	MAXIMUM QUANTITY	MAXI-MUM HEIGHT	FIRE SEPARATION
MERCAN-TILE	IB,IC,II,IIIA COMBINED	4 GALLONS/SF	N/A	PROTEC-TED AREAS
	IB,IC,II,IIIA COMBINED (GROIUND FLOOR)	2 GALLONS/SF	N/A	UNPROTEC-TED AREAS
	IB,IC,II,IIIA COMBINED (OTHER THAN GROUND FLOOR)	1 GALLON/SF	N/A	UNPROTECTED AREAS
MANU-FACTURING WITH INCIDEN-TAL USAGE				QUANTITIES IN EXCESS OF A DAY'S USAGE MUST BE IN STORAGE CABINETS, APPROVED TANKS OR INSIDE STORAGE ROOM

*If approved by authority having jurisdiction

**Per fire area (Areas separated by 100 feet)

INSIDE STORAGE ROOMS

TOTAL FLOOR AREA	AUTO FIRE PROT REQUIRED?	ALLOWABLE GALLONS PER SF FLOOR AREA
UNDER 150 SF	NO	2
	YES	5
150 - 500 SF	NO	4
	YES	10